US009176731B1

(12) **United States Patent**
Ziftci et al.

(10) **Patent No.: US 9,176,731 B1**
(45) **Date of Patent: Nov. 3, 2015**

(54) **HEURISTICS FOR AUTOMATED CULPRIT FINDING**

(71) Applicant: **GOOGLE INC.**, Mountain View, CA (US)

(72) Inventors: **Celal Ziftci**, San Diego, CA (US); **Vivek Ramavajjala**, New York, NY (US)

(73) Assignee: **GOOGLE INC.**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 2 days.

(21) Appl. No.: **14/011,020**

(22) Filed: **Aug. 27, 2013**

(51) **Int. Cl.**
G06F 11/36 (2006.01)
G06F 9/44 (2006.01)

(52) **U.S. Cl.**
CPC .. ***G06F 8/71*** (2013.01); ***G06F 8/73*** (2013.01); *G06F 11/3604* (2013.01); *G06F 2201/84* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,662,312	B1 *	12/2003	Keller et al.	714/38.14
7,503,037	B2 *	3/2009	Banerjee et al.	717/124
8,321,407	B2 *	11/2012	Cohen et al.	707/718
2005/0120299	A1 *	6/2005	Murray et al.	715/513
2005/0223357	A1 *	10/2005	Banerjee et al.	717/120
2009/0216712	A1 *	8/2009	Cohen et al.	707/2
2011/0055826	A1 *	3/2011	Vidal et al.	717/177
2011/0283270	A1 *	11/2011	Gass et al.	717/168
2013/0290960	A1 *	10/2013	Astete et al.	718/1
2014/0223416	A1 *	8/2014	Cohen et al.	717/123
2014/0282401	A1 *	9/2014	Tsirkin	717/123
2014/0310688	A1 *	10/2014	Granshaw et al.	717/123
2014/0325477	A1 *	10/2014	Hawes	717/120
2014/0337672	A1 *	11/2014	Hanzaike et al.	714/38.1

OTHER PUBLICATIONS

Ren, X., Change Impact Analysis of Java Programs and Applications, Dissertation, Graduate School, Rutgers University-New Brunswick, Oct. 2007, 129 pages, [retrieved on Mar. 25, 2015], Retrieved from the Internet: <URL:https://rucore.libraries.rutgers.edu/rutgers-lib/23844/pdf/1/>.*

Elbaum, S., et al., Code Churn: A Measure for Estimating the Impact of Code Change, Computer Science Department, University of Idaho, 1998, 8 pages, [retrieved on Oct. 31, 2014], Retrieved from the Internet: <URL:cse.unl.edu/~elbaum/papers/conferences/icsm98.pdf>.*

Ryder, B., et al., Change Impact Analysis for Object-Oriented Programs, Proceedings of the 2001 ACM SIGPLAN-SIGSOFT workshop on Program analysis for software tools and engineering, 2001, pp. 46-53, [retrieved on Mar. 25, 2015], Retrieved from the Internet: <URL:http://dl.acm.org/>.*

* cited by examiner

Primary Examiner — Thuy Dao
Assistant Examiner — Geoffrey St Leger
(74) *Attorney, Agent, or Firm* — Birch, Stewart, Kolasch & Birch, LLP

(57) **ABSTRACT**

A system and method for isolating one or more code changes which are suspected of causing a code failure are disclosed. An example system may include a backend, a frontend, and a datastore. A list of changes to a codebase may be received along with a list of test targets in the codebase that are failing and a snapshot of the codebase at the time when one or more of the codebase's tests started failing. A heuristic may be used to find the code changes causing the one or more code failures.

11 Claims, 8 Drawing Sheets